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JULY 8, 1940
VOLUME 29, No. 14

AMERICAN DYESTUFF REPORTER

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DYESTUFF REPORTER

VOLUME 29 JULY 8, 1940 NUMBER 14

Electrodialytic Estimation of

Ash and of Acidic and Basic Groups

in Textile Fibers

ARNOLD M. SOOKNE, CHARLES H. FUGITT, and JACINTO STEINHARDT*

ABSTRACT

Considerable practical interest attaches to the ash of textile fibers. It is well known, for example, that the electrical properties of textiles such as cotton, silk, and wool depend to a considerable extent upon the nature and amount of inorganic substances in the fibers. In addition, this ash content influences the uptake of moisture and dyestuffs, as well as the ability of the fiber to combine with certain softening or finishing agents.

The method of combustion usually employed for the estimation of the ash yields results which acquire significance in terms of equivalents only when an estimate of the composition of the ash can be made. Since the ash may contain substances, such as sulfate in the case of wool, which are not in the unburned fiber, but which are formed during the combustion process, its composition is uncertain at best.

It is shown by recent work of the research associates of the Textile Foundation at the National Bureau of Standards that the hydrogen-ion equivalence of the cationic ash of fibers (the total content of the cations of bases whether free, or combined with acids, or with the acid groups of the fibers) may be obtained directly, without ignition, by existing electrodialytic procedures which have been hitherto applied principally to biological solutions. Only simple and inexpensive equipment is required. The content of any given anion in the sample may be similarly determined. By duplicating the procedure on a larger scale, the method has been used to obtain samples of fibrous materials of very low ash content. A simple extension of the method which permits the quantitative determination of the acidic and basic groups in the material consists in combining them with suitable tightly bound cations or anions which are subsequently estimated by the electrodialytic procedure.

Examples are given of the application of the method to dewaxed and to depectinized cotton. In both cases the results are shown to correspond with the capacity of the fibers to bind acid. Examples are also given of ash determinations on wool fibers and on samples of wool cloth at several stages in processing subsequent to the carbonizing process. A comparison of the results with the ash obtained gravimetrically on similar samples, after combustion, permits the estimation of the average equivalent weight of the constituents of the ash, and aids in their identification. It is shown that the largest part of the ash of untreated wool, as obtained by combustion, consists of sulfates. Since sulfates are not present to an appreciable extent in washed (defatted) root-wool fibers, the presence of this anion in the ash of such fibers must be attributed to the oxidation of the sulfur of the wool during combustion. The much larger ash remaining after carbonizing, neutralizing, and rinsing is also in the form of sulfates, but at these stages most of the sulfate has been contributed by the sulfuric acid in the carbonizing process.

I. INTRODUCTION

CONSIDERABLE practical and theoretical interest attaches to the estimation of the ash of textile fibers. The method of combustion, usually employed, is time-consuming and yields values which acquire significance in terms of equivalents only when an estimate can be made of the composition of the igneous residue. In addition, this method may sometimes give values which do not accurately represent the inorganic constituents in the unburned fiber. Thus, the ignition of wool results in the formation of sulfate from the oxidation of part of the organic sulfur of the amino-acid, cystine, which con-

*Research Associates at the National Bureau of Standards, representing the Textile Foundation, Inc.

stitutes an appreciable part of this protein. Consequently the ash of wool is heavier than it would be if all of the inorganic bases combined with it were found as carbonates or oxides.

The method of electrodialysis used by Joseph and Stadie[1] for the determination of total cations and chloride in blood, has been found to be of value for the estimation of the equivalence of the cationic ash of textile fibers (the term cationic ash in this paper signifies the total content of the cations of bases, whether free, or combined as salts of acids or of the acid groups of the fibers*). This method permits the direct estimation of the hydrogen-ion equivalence of the cationic ash; in addition, it may be extended to include the estimation of specific anions, such as sulfate, which are important in the control of textile finishing processes. Unlike the combustion method, electrodialysis has preparative as well as analytical value, since the samples used in analysis may be recovered, freed of most of their ash, at the end of the determination.

Besides describing the procedure which may be employed with a number of textile fibers and demonstrating the accuracy of the results obtained, the present paper also suggests simple extensions of the procedure which render it applicable to the direct determination of the acidic and basic groups of a wide variety of materials, including fibers.

II. METHOD

In the present investigation, the method of Joseph and Stadie was followed with two modifications: (a) The addition of dilute acid to the sample to be dialyzed aided in the liberation of cations combined with the fibers, and greatly shortened the time required for their recovery at the cathode. (b) The formation of a reliable seal between the Cellophane membranes and the sides of the dialysis tubes was considerably expedited by the substitution of a commercial cellulose nitrate cement†, for the collodion employed by Joseph and Stadie. A diagram of the apparatus employed, copied from the original article, is given in Figure 1. The application of a potential difference across the electrodes brings about the migration of cations to the mercury cathode, where they are discharged and form amalgams. Subsequent mixing of the amalgam with the standard solution of hydrochloric acid above the mercury causes a reduction in its titer which corresponds to the hydrogen ion equivalence of the cationic ash. The titers of the original and final solutions were measured with a 0.02 M solution of sodium hydroxide, using bromcresol purple as the indicator. When chloride is among the anions present, it is discharged at the anode unless, as in Joseph and Stadie's method, a suitable reducing agent is added to the anode chamber in order to prevent this. When sulfate is present, oxygen is evolved and sulfate accumulates in the anode chamber. The quantity of

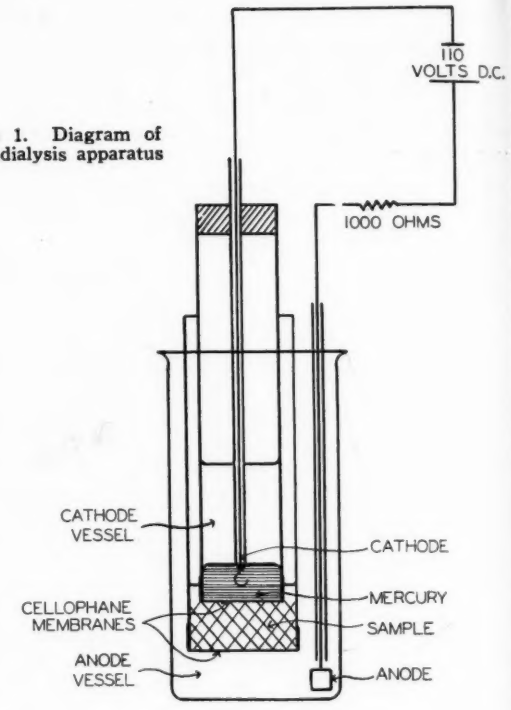

Figure 1. Diagram of electrodialysis apparatus

sulfate in the sample may then be determined gravimetrically by precipitation as barium sulfate.

In the method actually employed, a sample of purified cotton, wool, or silk weighing between 0.5 g and 1 g was placed in the sample chamber, and soaked in a dilute solution of hydrochloric acid for an hour, after which the sample was electrodialyzed for two hours. A resistance of 1,000 ohms in series with the electrodes gave an initial passage of current of about 100 milliamperes, which diminished rapidly as the removal of ions progressively raised the resistance of the dialysis chamber. The accumulation of bubbles of gas on the membranes is avoided by occasionally tapping the outer glass tube. With cotton, identical results for the cationic ash were obtained when 0.02 M or 0.15 M solutions of hydrochloric acid were used for the soaking treatment. Longer periods of electrodialysis did not appear to increase the effectiveness of recovery of the cationic ash of cotton. With wool, however, slightly more consistent results were obtained with longer initial periods of exposure to acid, and with the higher concentration of acid. Samples of cotton freed of inorganic ions by this treatment yielded no measurable igneous residue.

III. RESULTS AND DISCUSSION

1. Cotton

The cationic ash is a factor of primary importance in the behavior of naturally-occurring cellulosic materials toward acids. Following the demonstration by McLean and Wooten that a linear relationship obtains between the contents of cationic ash and the acid-binding capacities of various cellulosic materials at an arbitrary pH[2], Sookne

*The term is equivalent to the conventional expression "total base" used by Joseph and Stadie in the paper cited, and by biochemists generally.

†Duco cement, made by E. I. DuPont de Nemours & Company was employed.

and Harris have shown that the limiting amount of acid with which cotton can be made to combine at low values of pH corresponds to the hydrogen-ion equivalence of its cationic ash[3]. The results of electrodialytic analysis of cotton may therefore be compared directly with the results obtained by an independent method. Table 1 lists

TABLE 1
The Hydrogen-ion Equivalence of the Cationic Ash of Samples of Dewaxed Cotton

Weight of Fibers, dry basis	*Cationic Ash millequiv.*	*Cationic Ash millequiv./g*
0.5065	0.0324	[a]0.0640
.5159	.0340	.0659
.5092	.0305	.0599
.5176	.0334	.0645
.5095	.0302	.0593
		Mean 0.0627

[a]Since the titer differences from which the data of these tables were computed had a precision of 1 part in 150, the data could be represented by either 2 or 3 significant figures. They are given to 3 figures to permit a better estimate of their reliability.

determinations of the cationic ash of a sample of dewaxed cotton, the preparation of which has been described elsewhere[3]. The values given have been corrected by subtracting a blank of 0.0040 milliequivalent of acid, a value determined empirically by numerous control runs on the dilute acid solutions in the absence of fibers. Experience has shown that the major source of uncertainty in the final result is the extent to which the blank is reproducible. The mean of the values given is 0.0627 milliequivalent per gram of cotton, in good agreement with the value for the maximum acid-binding capacity of the same sample, 0.066 milliequivalent per gram[3] determined by direct titration.

The completeness of recovery of the cations was tested by adding 0.0200 milliequivalent of potassium chloride to weighed samples, identical with those described above, before making the determinations. The results of these measurements are given in Table 2. The second column

TABLE 2
The Recovery by Electrodialysis of Potassium Ion Added to Samples of Cotton

Weight of Fibers, dry basis g	*Total Cationic Ash millequiv.*	*Cationic Ash of Cotton millequiv.*	*K^+ Recovered millequiv.*	*K^+ Added millequiv.*
0.5106	0.0519	0.0320	0.0199	0.0200
.5115	.0523	.0321	.0202	0.0200
.5129	.0525	.0322	.0203	0.0200

represents the recovery of cations, combined plus added, the third column lists the cationic ash of the cotton calculated from the weight of the sample and the value 0.0627 milliequivalent per gram obtained in the preceding experiments. The recovery of *added* potassium, shown in column 4, is obtained by subtracting the figures of the third column from the corresponding figures of column 2. The resulting figures indicate very complete recovery of added potassium, and furnish strong evidence for the accuracy of the figures for the naturally-occurring cations.

2. Wool

The ash content of samples of wool from different sources may vary over wide limits. A large part of the cation content of wool is combined with the acidic groups of the protein (as $RCOO^- M^+$). Consequently, close agreement between measurements of the amounts of acid bound by wool protein in different lots of wool at any given pH may only be achieved by subtracting the hydrogen-ion equivalent of the combined cations in each lot of wool from all directly determined values of the acid bound under any given conditions[4]. Thus a method is required for determining the equivalence of the ash rather than its weight per cent, unless its composition is accurately known. Such a method, described in this paper, is also useful in wool processing, as for example in the control of neutralization and rinsing after the carbonization of wool.

Representative determinations of the ash of fibers, from two different sources, which had been extracted with alcohol and ether and washed with water are given in Table 3. It will be noted that longer intervals of time were

TABLE 3
The Equivalence of the Cationic Ash in Wool Fibers. 3 ml. of 0.15 *M* HCl Were Added to Approximately 0.5 g. of Wool.

Time of Preliminary Soaking in acid hours	*Time of Passage of current hours*	*Cationic Ash millequiv./g*	*Ash by Combustion at 700° C. mg/g*	*Empirical Equivalent Weight of Ash g*
2.0	2.0	0.035	2.60	74.2
2.0	2.0	[a].029	2.60	89.5
2.0	3.5	.037	2.60	70.3
1.5	4.3	.036	2.60	72.2
3.0	3.0	.036	2.75	76.3
3.0	3.0	.151	11.4	75.5

[a]In the course of this measurement, it was observed that the passage of current was impeded by the accumulation of gas bubbles. It seems likely that this observation explains the apparently incomplete recovery of combined cations in this single determination.

employed than in the work with cotton. When appreciably shorter periods were allowed for soaking in acid, or for electrodialyzing, the resulting figures were lower and lacking in reproducibility. It has been shown that when wool is immersed in dilute solutions of acid the attainment of equilibrium requires much longer periods than when cotton fibers are similarly treated[3, 4]. The shorter times sufficing for cotton are probably due to the fact that the greater part of the combined cations of dewaxed cotton are associated with an outer shell of pectic substance which is more readily dissolved in dilute aqueous solutions than is the cellulosic part of the fiber[3, 5, 6]. The longer interval required for complete ionic recoveries in the electrodialysis of wool is probably a consequence of the same factors which delay its attainment of equilibrium with solutions of acid.

The empirical combining weights of the ash (milligrams of ash on ignition divided by milliequivalents of cations recovered on electrodialysis), are given in the last column. These have been calculated in order to provide a partial test of the reasonableness of the values obtained by electrodialysis and incidentally to determine approximate empirical factors for interconverting the quantities determined by electrodialysis and by combustion. The combining weights shown are somewhat higher than can be accounted for if the ash is largely composed of the oxides of potassium, calcium, magnesium, iron, or aluminum, the

combining weights of which are 47, 28, 20, 26, and 17 respectively. Since spectroscopic examination of the ignited residue indicated the presence of relatively large amounts of calcium, aluminum, and silicon, the average combining weight may be accounted for in part by the presence of silicates or of silicon dioxide, neither of which would affect the equilibria with dilute acids. In addition, part of the sulfur of the protein is oxidized to sulfate on ignition, and the weight of the ignited residue, and thus the empirical combining weight is increased. The combining weights in the table are very close to those which would characterize the sulfates of the cations known to be present*. A comparison of the combining weights in the table with the combining weights calculated from the results of direct titration of the ignited residue with acid, showed that less than half of the residue obtained after combustion was capable of combining with acid. This is consistent with the fact that a very large part of the ash is in the form of sulfate. The results tabulated also furnish a strong indication that the average combining weights of the ash from lots of wool characterized by widely different ash contents are sufficiently alike for these combining weights to be used as factors for interconverting the results which would be obtained by electrodialysis and by combustion.

An example of the manner in which the electrodialysis may be applied to routine mill analyses is given below. Both ash and cation determinations were made on pieces of undyed worsted and woolen cloths at different stages of the neutralization and rinsing processes directly following the carbonizing process.† The results of these measurements are summarized in Table 4.

TABLE 4
Ash Content of Undyed Pieces of Wool Cloth at Various Stages in Processing. Averages of Three Determinations on Samples of 0.8 g. Soaked for 2 hours in 3 ml. of 0.15 *M* Hydrochloric Acid, and Electrodialyzed for 2 Hours

Nature of Cloth	*Stage in Process*	*Cationic Ash*	*Ash by Combustion at 700° C.*	*Empirical Equivalent Weight of Ash*
		milliequiv./g	*mg/g*	
Lightly woven worsted	[a]water rinse	0.025	0.65	26.0
	soda washed	.439	23.6	53.8
	partially neutralized	.071	5.0	70.8
Open weave, woolen & worsted combination	[a]water rinse	0.020	0.90	45.5
	soda washed	.143	8.15	57.0
	"completely neutralized"	.015	1.35	89.5

[a]These samples contained over 2 per cent of sulfuric acid.

All the samples, including those which had been carbonized with sulfuric acid and then merely rinsed with water, contained a non-volatile mineral residue. In those samples which were merely rinsed, this residue was so small as to render the calculated combining weights uncertain. However, the combining weights of the much larger amounts of ash obtained from the two samples treated with sodium carbonate are closely similar and are not far different from the combining weight of sodium carbonate, which is 53. Owing to the large excess of ash in these samples over the amount of ash originally in untreated wool, the effects of the original ash on the average combining weight of these samples is practically negligible. Nevertheless, the close agreement between the experimental and theoretical combining weights of the ash of these samples may be in part coincidence. A considerable part of the carbonate originally present must, however, have been transformed into sodium sulfate by neutralization of sulfuric acid remaining on the cloth; if all of it were so transformed, the combining weight would have been 71. It therefore appears likely that sulfates and oxides (formed by decomposition of carbonates, and from sodium ions combined with the wool itself) were present in addition to carbonate, with a resulting average equivalent weight close to the theoretical value for sodium carbonate. This suggestion receives some measure of support from the fact that a large part of the soda *in the unburned sample* had reacted with sulfuric acid and was present as sulfate. Thus, only 0.24 millimole of acid per g. was required to neutralize the free base in a sample of the soda-treated cloth, although the total cation equivalence, as determined by electrodialysis was 0.44 millimole, almost twice as great.

As the table shows, the combining weights tend to rise after even partial neutralization and washing out of the soda-ash. On "complete neutralization" they rise still more. Since the "neutralized" material was low in ash before the soda treatment, the ash remaining after neutralization must have resulted largely from this treatment. The rise in the combining weight indicates that most of the carbonate, which would yield an ash of low combining weight, has been removed by washing, leaving sulfate of sodium and, to a much less extent, of other heavier ions initially in the fiber.

The feasibility of determining electrodialytically the sulfuric acid in the carbonized fibers, as distinguished from the sum of this quantity plus the sulfate formed in combustion, has been demonstrated in work with wool yarn previously treated with sulfuric acid. Samples of wool in the central chamber of the apparatus were immersed in 0.15 *M* sodium hydroxide and exposed to the passage of current for four hours. At the end of this period the contents of the anode chamber were analyzed gravimetrically for sulfate. The results agreed closely with similar sulfate analyses made on the total hydrolytic products of other samples of sulfuric acid treated wool which had been decomposed by hot concentrated hydrochloric acid.

By simultaneously measuring the hydrogen ion equivalence of the cations and of sulfate and determining the difference between them by subtraction, a figure of interest

(Continued on page 355)

*Gravimetric analysis of some of the ashes reported in Table 3 showed that 42 per cent of their weight was SO_4.

†The authors are indebted to Mr. Werner von Bergen, Director of the Research and Control Laboratories, Forstmann Woolen Company, Passaic, New Jersey, for furnishing the samples used. A description of the stages in the neutralizing and rinsing process to which the table and text refer will be found in the American Wool Handbook, 1st edition, page 563.

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• CALENDAR • OF COMING EVENTS

Outing, South Central Section, Lookout Mountain Hotel, Chattanooga, Tenn., August 2 and 3, 1940.

Annual Meeting and Convention, auspices New York Section, October 18th and 19th, 1940, Hotel Commodore, New York City.

Meeting, Piedmont Section, Carolina Hotel, Pinehurst, N. C., November 1 and 2, 1940.

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These buttons, bearing the seal of the Association, can be purchased by members in good standing from the Secretary at $1.50 each.

When Cotton Goes to Market*

B. J. KANE**

A COUNTRY peckerwood like me has his nerve making a talk on cotton to you when you have been addressed by Dr. Murchison of the Textile Institute but in a moment of weakness I consented to do it and so here goes. After Mr. Gill left my office I tried to think what it was that made me such a fool as to agree to this and I still can't figure it out, unless that I figured it would be easy when he assured me that this was a gathering of chemists and none of you would know enough about my subject to dispute anything that I said. When I asked him what phase of cotton business he wanted me to discuss he said "It doesn't matter, either the growing, buying, classing or hedging. Now twenty years ago I would have attempted to tell you authoritatively about all four, but tonight I can tell you positively, since I now own a farm, that there are so many factors entering into the growing of cotton that the farmer is the greatest gambler on earth, and I have proven to myself that I don't know how to grow cotton. As to the buying, after twenty-nine years attempting to buy for a large cotton mill I am sure that no one can tell any one else how cotton should be bought and not be laughed at. As to the classification, after seeing the outturns of the Arbitration Boards when mills and shippers disagree, I realize that I know less and less about the classification and staple of cotton; and since the Government has gone into the cotton business and become the owner of ten million bales, and with the distant months selling at a discount, any one that is smart enough to hedge cotton correctly doesn't have to work for a living any more. Therefore before I start let me tell you frankly that, since I can't tell you all about the things Mr. Gill wanted me to tell you about, I will just tell you generally about cotton and not bore you with meaningless statistics or technical discussion.

The first crop that we have any data on is 1790, when they made 8,889 bales weighing 225 pounds. Contrast this with almost 50 million acres and with crops of almost 18 million bales and it gives you some idea of the strides forward that have been made. Cotton for years had been probably the most important item in our international trade balance.

Cotton, it is often supposed, can only be raised in a very warm country, and of course long hot summers with late frost dates help a lot, but really cotton is a temperate zone plant, and can be raised in every part of the world from 37 degrees north of the equator to about the same degrees south of it. Cotton was raised during the Revolution on farms in south Jersey and Pennsylvania and the lint spun into yarn on the same farms; however the early frost date and the invention in 1793 of the cotton gin by Eli Whitney made it cheaper for the Jersey and Pennsylvania people to buy cotton yarn made from Southern cotton than to raise it themselves. The Southern States are well adapted to the growth of cotton and we can see from the ending of Henry Grady's famous speech "The Cotton Plant" that the South at that time thought their supremacy in the growth of cotton would never be questioned. He said "What a royal plant it is! The world waits in attendance on its growth. The shower that falls whispering on its leaves is heard around the earth. The sun that shines on it is tempered by the prayers of all the people. The frost that chills it and the dew that descends from the stars is noted, and the trespass of a little worm on its green leaf is more to England than the advance of the Russian Army on her Asian outposts. It is gold from the instant it puts forth its tiny shoot. Its fiber is current in every bank, and when loosing its fleece to the sun, it floats a banner that glorifies the field of the humble farmer; that man is marshalled under a flag that will compel the allegiance of the world, and wring tribute from every nation on earth. It is the heritage that God gave to this people forever as their own when he arched our skies, established our mountains, girt us about with the ocean, loosed the breezes, tempered the sunshine and measured the rain. Ours and our children's forever! As princely a talent as ever came from His hand to mortal stewardship."

The Southern farmer of today knows that with the boll weevil, Government control and loans this picture has been changed entirely as we have taught the world to produce cotton while maintaining an artificial market so that they made money while they learned; and "The heritage that God gave to this people forever as their own" will only be their heritage from now on if they want to raise large crops of cotton to sell to the world at a cheap price. The South can't afford to raise cotton to sell the world at six cents a pound and buy the tools to make it with at high prices protected by tariffs, pay $35.00 a ton for fertilizer, buy calcium arsenate to poison with, and pay 75 cents to one dollar per hundred for picking seed cotton.

The northern line of cotton production crosses southern Virginia from the vicinity of Norfolk, runs down through

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**Fulton Bag & Cotton Mills, Atlanta, Ga.

the two Carolinas as far up into the mountains as frost will permit cotton to be grown, along the northern boundary of Georgia and Alabama up into the southwest corner of Tennessee and so reaching the Mississippi River. West of the River the line goes up into southeastern Missouri and southwest across Arkansas and so through the center of Oklahoma to the western edge of the cotton belt. The line then runs down to San Antonio and to the Gulf at Brownsville on the Rio Grande. This of course doesn't include California, Arizona and New Mexico, but is what is known as the Old Cotton Belt, which has been growing cotton for the last 150 years. When the trade speaks of this belt they divide it into four parts (1) The Atlantic States (2) The Gulf States (3) The Mississippi Valley (4) Texas and Oklahoma. There are some subdivisions of these four parts and Georgia and the upper parts of the Carolinas are called the Piedmont Section. We in the Piedmont suffer more from early frosts than the lower parts of the Atlantic States but, being nearer the mountains, showers are more frequent in dry spells. The central and southern parts of Georgia and South Carolina have more clay than the Piedmont and are called the "Redlands." While all of the Atlantic States need fertilizer to make a crop, the Redlands need less potash than the sand nearer the coast or the lighter land of the hill section. The red clay section of southwest Georgia has the earliest cotton in the United States except for Southwest Texas, known as the Rio Grande Valley, a fact of great importance in years of small carryover or carryover of poor quality, or in years when merchants sell July delivery and due to weather conditions the crop gets late. Along the coast of the Carolinas and Georgia is raised a variety of cotton called "Sea Island," which is the longest staple grown in the United States and is very much like Egyptian cotton in every way, length, strength and silky character of fiber. The weevil ruined this crop, as in 1911 they raised 122,000 bales and in 1920 only 4,000 bales. The Department of Agriculture is reviving the growth of this kind of cotton and is breeding an early maturing variety to get ahead of the weevil. Too much can not be said for the good work being done by our Agricultural Colleges and the Department of Agriculture in getting seed that produces as much or more lint cotton of a stronger character and longer staple and matures early enough to beat the weevil. We can't speak of improvement in seed without paying tribute to Mr. J. L. Coker of Hartsville, S. C., who was the greatest cotton seed breeder that this country has ever produced and who did a wonderful service for the South. Now each of the other three parts of the cotton belt is also subdivided by the trade and probably the Delta, which means northwestern Mississippi from Vicksburg to Memphis with the river countries of Louisiana and Arkansas on the opposite bank, is the finest cotton land in the belt. Where cotton in this section only grows as high as your knee or at best as high as your waist, I have seen pickers in the fields of the Delta where you could barely see the tops of their heads. For years the Yazoo and Mississippi rivers overflowed miles of this land every spring and left a deposit of silt. For the past 25 years our system of levees, some of them built several miles back from the river, have held the rivers in bounds, and each year there is a crop planted inside the levees, gambling that the "June rise" will not overflow the main banks of the river. In this section of the belt the plantations are much larger, and as no terracing has to be done, the cotton is planted in long straight rows. Of course Texas, which is the size of France, has many different kinds of soil and climates and the trade divides it up as "West" "Central" and "East" one way and "North" "Central" and "South" the other. The great portion of this cotton in normal times "goes Export" from the gulf ports of Houston and Galveston. About 40 years ago cotton cultivation began in the Imperial Valley, partly in California and partly in Mexico. The Department of Agriculture helped these people to learn how to grow cotton by irrigation and they developed the Pima or American Egyptian long fiber variety. This cotton brings good prices on account of its length and the Egyptian import duty of 7 cents per pound and their yield per acre is very high since they can make it rain as they need it. This is now the California-Arizona crop. This gives you a fair picture of the geography of the belt and the next thing to touch on should be cultivation. Anything that I say pertains to the Old Cotton Belt as I know nothing of raising cotton by irrigation.

We probably should start like the bulletin issued by the Department and say "Cotton is an annual and is planted fresh every year. The acreage planted changes from year to year due to various things:— the price of cotton the previous year, the price of fertilizer, feed and food prices, the labor problem, etc." The Department issues about July 8th a condition figure of the crop as of June 25th and an acreage figure and its estimates are very accurate. From now until this report we will have guesses and predictions of the acreage planted and yield. Some will want to buy and some to sell and all will agree that if you don't act immediately you are ruined. There is no agency that can make an estimate that will in any way compare with the Government, as the private reporters would have to spend over $100,000.00 to make the report each month and since the Government makes a report each month from July through December, it would cost half a million dollars and no crop reporter could get enough subscribers to pay this amount. The actual planting of the cotton crop takes place in the spring but all good farmers do a lot of work in the fall and winter. Soon after gathering of the last crop all old cotton stalks should be cut down and burned to eliminate weevil hibernation and the land plowed thoroughly and deep and softened for the winter rains. This plowing will turn up insects so that "winter in the soil" and the cold and ice will kill them. Boll worms, cut worms and grass

hoppers all are reduced in this way and also it is claimed damage from fungus growth such as pink boll rot and Texas root rot is partly eliminated. Where the land has been prepared like this and they get good heavy winter rains they call it "season in the ground." This is very important in making a crop but it is not absolutely necessary. If you don't have good winter rains your weather has to be perfect and nine times out of ten we have a drought condition in spring and early summer. With no sub-soil moisture to feed the tap roots until you can get good rains, your crop soon gets in bad shape; therefore the trade always feels more secure when they have good season in the ground to start a crop. This is why the Weather Bureau publishes every spring the winter rainfall, not only by states but by individual stations, and then issue daily reports during the growing season.

Aside from Southwest Texas, which is partly below the frost line and is too early to be considered with the rest of the crop, planting begins along the gulf about March 25th and extends north into the central portion of the belt between April 10th and May 1st, reaching the northern border between April 20th and May 15th. These are normal dates and cotton can be planted earlier or later, but earlier planting probably will be killed by frost, and later the damage from the weevil must be reckoned with. We have recently had numerous letters on account of cold and wet weather saying that the crop was at least two weeks late. With good weather cotton comes up quickly after planting, showing two small leaves just above the surface of the ground and if you pull it up you will find small tap roots stretching down into the ground. If after planting they have moderate rains mixed with good clear hot nights, and all of the seeds germinate, they get what they call "good stands." Dry weather with cool nights causing some of the seeds not to germinate, or too much rain causing some seeds to rot, brings on what is called "bad stands" and causes replanting and affects the total very much. As soon as the farmer gets a stand the crop is then "chopped out" leaving the most vigorous and best plants in the rows. The old plantation rule of cultivation "once a week and one in a row" is still a good rule. This plowing has to be done just right as deep plowing too close to the plant after it has "set" will cause excessive shedding of the early bolls. Since the advent of the weevil the old custom of "laying by" has been more or less abandoned and cultivation is kept up as long as possible. Since cultivation can't be carried on when the ground is wet and the seeds not only rot but the grass and weeds get out of control, it can be easily seen why the trade watches the weather over the entire belt in May, June and July. The crop on an average probably looks better in June than at any other time, which causes the saying in the trade that "The man that can sell the June prospect at the August price won't have to work again soon." After the 1st of July the crop begins to fruit or put on squares which are three leaves curled together with the flower bud inside. The squares usually come about 3 weeks before the bloom which is cream colored the first day, changing to red or pink the second day and falling off the plant the third day. From the time the flower or bloom drops off, leaving the little pod, until the grown boll with cotton hanging out of it is about 50 days, hence the saying "Six weeks from the bloom to the boll." High temperatures of over 100 for any length of time will cause shedding. Killing frost dates have a bearing on the size of the crop. Extra early frost reduces the yield and extra late frost adds to the yield. So much for cultivation.

Probably the next thing to mention is the boll weevil. The weevil lives over the winters in fence corners, standing timber, rubbish and uncut cotton stalks. If the weevil is in the open or not very well hibernated it is easy to kill, as temperatures of 100 and over where the direct rays of the sun can get to it or winter weather of 10 degrees above zero will kill it. The South is far less tropical than a lot of people believe. I was in Memphis, Tenn., during the season of 1917-18 when the thermometer was 13 degrees below zero on Front Street. The average weevil survival is 12.8 per cent in mild winters to 2.85 per cent in severe winters and only adult weevils survive. Their emergence in the spring varies with the rainfall and the temperature but since they are now over the entire belt we might say the emergence date is from March until June. After emerging, experiments show the weevil can survive without food for 90 days. An egg hatches in three days. In 7 to 10 days it passes into its pupa stage, in three to five days is an adult weevil, and in five more days it begins the production of another generation. The female lays from 12 to 20 eggs per day and won't lay an egg in a square that another female has deposited an egg in. Professor Coad of the Department of Agriculture at Tallulah, La., says that males and females are produced in about the same number. I had one of our accountants figure the possibilities of one pair of weevils production in one season and before he was through the figure was so large that it ran out of the calculating machine. Of course we figured that they all lived but tests show that 90 per cent don't reach the adult stage. Ants are known to have killed off 35 per cent in the grub stage in one field. It is said that the weevil crossed the Rio Grande from Mexico to Brownsville, Texas, in 1892. By 1900 Texas was over 50 per cent infested, by 1903 they were reported in Louisiana, by 1907 they had crossed the Mississippi River and in 1910-11 reached Alabama, touched the Georgia line in 1914 and covered North Carolina by 1921. Increase in damage done the cotton crop may be seen from the following. Season 1911, 1.28 per cent; 1913, 6.69 per cent; 1915, 9.93 per cent; 1917, 9.34 per cent; 1919, 13.20 per cent and 1921, 34 per cent. Since this is a body of chemists you probably will wonder why the weevil wasn't controlled by poison. This is very hard to do as the weevil feeds from the soft part inside the square which

he reaches with his snout. Professor Coad found by long and careful observation that the weevil had a distinct tendency to seek moisture wherever it could be found on the plant. He found that calcium arsenate could be dissolved by the moisture or dew on the plant, would dry out the following day, dissolve that night and so on for three or four days. The powder has to be dusted on at night when the air is still by hand guns or mule sprayers or tractors and in some cases by airplanes. No other method of poison has been discovered that will equal calcium arsenate dusting so here's a wonderful opportunity for some smart boy to step out.

The next step in getting the crop to market is "picking." Each picker has a long bag fastened across his shoulders and dragging behind him on the ground into which the cotton is put as fast as it is picked from the bolls. Pickers are paid for the number of pounds of seed cotton picked in a day and settlement is made each night. Each year we have the old story that due to lack of labor the crop can't be picked but they never fail to get every lock if the price is good. Negroes really enjoy the work as each takes a row and they can stay in a crowd and talk and laugh as they pick and I have been told by men who own large farms that the negro servants in the house all want to get out in the fields to pick cotton.

The next step is to remove the seed from the lint. Roughly we might say it takes 1,500 lbs. of seed cotton to make a 500-lb. bale of lint cotton. The cotton gin as Whitney invented it is still the ordinary saw gin used today. This saw gin is a cylinder about four feet long and six inches around on which is a set of circular saws. The mass of seed cotton is brought in contact with the saws while they are revolving but separated from the cotton by steel bars or gratings. The teeth of the saws catch the cotton while playing between the gratings which do not let the seed through. Underneath the saws are stiff brushes revolving in the opposite direction which removes the cotton from the saw teeth to be blown by a blast of air to a conveyor and then to the gin box and made into a bale. There are many devices for cleaning the cotton while ginning it and some of them do very good work. Probably the heater which dries the cotton after it comes from the wagon bed and before it is ginned is going to eliminate much of the gin cut cotton that we get in Georgia at present. The only trouble about any new ginning device is that it costs so much to install and the fee for ginning a bale in Georgia is so little. Volumes have been written on gin saw speeds, cleaning devices, temperatures at which heat pipes should be kept so that it doesn't hurt the staple, etc., but we can't spend any more time on ginning. After ginning, the lint of course is sold and part of the seed kept for replanting and part sold to be crushed for cotton seed oil which is the purest vegetable oil obtainable. After the seed is crushed for oil they make "cotton seed cake" which is used as cattle food and fertilizer. The South, getting away as she has from the "one crop" idea, uses this now to fatten cattle for market. The linters, which is the short fuzz taken from the seed which the gin saws missed, is used as batting for stuffing cheap mattresses, horse collars, absorbent cotton and gun cotton. It is said that some of the big guns on the larger ships consume 500 lbs. of linters per shot. During the last war linters went to 8 cents per pound. They cut from 65 to 150 lbs. of linters from ton of seed. Don't confuse lint cotton and linters. All Government report figures are made on lint cotton. This will be enough on linters and we will now discuss the handling of the bale of lint.

When a farmer sells his bale of lint three things happen to it. It is graded, stapled and weighed. The grade of a bale is determined by the color, trash or leaf, and preparation. The color can be extra white, white, spotted, gray, blue, tinged or stained. The leaf or trash is compared with government standard boxes called middling fair, strict good middling, good middling, strict middling, middling, strict low middling, low middling, strict good ordinary and good ordinary. You will note that there are nine grades and middling, as its name suggests, is in the middle of the list and is supposed to represent the average grade of all cotton grown. Therefore all quotations are for middling and all future contracts in New York and New Orleans are "basis middling." Trying to describe the standards would take someone that has a better command of the language than I have. After samples are drawn from each side of the bale and ticketed to identify it, the sample is sent to what is called a sample room, where they have good light, to be classed. Let me say here that cotton classing and stapling is an art and not an exact science. No two bales of cotton and no two samples out of the same bale are exactly alike in every particular and therefore an absolute match for the government standards is impossible. The American cotton merchant can sell his cotton in three ways:— "on description" to be equal to a Government standard, "on type" sending six or eight samples to represent a large lot, or on actual samples which means an actual sample of each individual bale drawn and sent to the buyer. This briefly covers grade so we now come to staple. Staple is the method of valuing cotton by the length and strength of the fiber and both qualities are important. The actual operation of pulling staple, as the trade calls it, is purely mechanical. I quote you the Department of Agriculture's description of the process: "A small piece of cotton is grasped with both hands and pulled apart. One-half is then discarded and the ends of the fibers projecting from the portion held, usually in the left hand, are grasped between the thumb and forefinger of the right hand and drawn from the mass. Two or three such pulls are made and the staple is then lapped back and forth until the fibers are parallel and the ends squared before the length is estimated. The character of the staple, that is its strength, body, drag and uniformity, is noted at the same time." The art of pulling and judging staple correctly is much more difficult

than classing for grade. A rule means very little to a "staple man" as the judgment of character, uniformity and strength is most essential. Staple lengths start at below ¾" and then ¾" and then by thirty seconds to 1⅜". Cotton over this length is almost certainly Pima or American Egyptian or Sea Island. The merchant sells cotton for staple the same as he does for grade.

Most cotton is handled on sight draft and it is generally understood that 100 bales of cotton shall weigh 50,000 lbs. with one or two per cent variation. This rule of course is to prevent shipment of light weight bales when the market is against the seller and heavy bales when it is in his favor.

Before cotton is shipped out of the South the bales are compressed and the railroad companies absorb the cost of compression as this enables them to load 75 bales to the car instead of 35. The compression is done at storage plants all over the South by regular steam or hydraulic presses.

We now have the cotton planted, picked, ginned, classed, stapled, compressed and in a railroad car. Frankly we haven't hardly started to talk about cotton and I have talked here it seems like half of the night. When I started to write this talk I listed some of the things that I was going to tell you about, and after talking on six of them here are the ones that we won't have time to talk about: Unmerchantable cotton, city crops, sandys, dustys, snaps, bollies, reginned and machined cotton, grabbots; foreign growth from Egypt, Indian, Russia, China, Brazil, Peru, West Indies and Mexico; supply and demand, consumption, government loans, export subsidies, methods of financing, factors, country supply merchants, country banks, co-operative and producers associations, ginners as buyers, warehousemen in small markets, warehouse receipts, interior railroad B/L, country street buying, small interior merchants, domestic and foreign shipments, foreign exchange; spinners' brokers—foreign, New England, Canadian and Southern; use of the futures markets—New York, New Orleans and Liverpool, as a hedge and as outright speculation; speculation on basis and speculation with hedges. It is very evident that we haven't time to discuss all of these but if you are interested and want to read two good books on the subject get "Cotton and the Cotton Market" written by W. Hustace Hubbard, who was a member of the old and reliable firm of Hubbard Bros. & Co., and also a later book called, "Cotton Goes to Market," written by Alston H. Garside, the present economist of the New York Cotton Exchange. They are both good.

The last note that I had down to talk on was "Futures Markets and Speculation." The word speculation seems to have a great fascination for all men and is probably the subject of more thought and discussion than any other element in marketing. There was an article published in the *Cosmopolitan Magazine* in 1888 entitled, "Speculation as a Fine Art," written by D. G. Watts. I quote, "Is speculation right? It may be questioned, tried by the highest standards, whether any trade where an exact equivalent is not given, can be considered right. But as society is now organized speculation seems a necessity. Is there any difference between speculation and gambling? The terms are often used interchangeably, but speculation presupposes intellectual effort; gambling, blind chance. The former has some of the elements of chance, the latter some of the elements of reason. We define as best we can. Speculation is a venture based on calculation; gambling a venture without calculation." Webster in his dictionary supplies the following definition: "Act of speculating, as by engaging in business out of the ordinary, or by dealing with a view to making a profit from conjectural fluctuations in the price rather than earnings of the ordinary profits of trade, or by entering into a business venture involving unusual risks for a chance of an unusually large gain or profit. *Speculation while confined within moderate limits is the agent for equalizing supply and demand and rendering the fluctuations of prices less sudden or abrupt than they would otherwise be.*" Speculation enters into the marketing of all commodities, not only cotton; and of course all speculators try to take advantage of their individual judgment of market conditions, supply and demand, etc. Everyone when he gets on the wrong side of the market is prone to blame speculators and speculation generally for his losses, and wants to have the law on them and have the legislative bodies investigate them and close the exchanges and put the future brokers in jail, but I can tell you truthfully that in the case of the cotton speculator he is no more responsible for small supplies and high prices or for large supplies and low prices then he is for the rains that ruin the crop in the Atlantics or the hot sun that dries it up in Texas. When we have a large carry over from the previous year and the mills buy only as much of their supplies as they feel justified in doing, the merchants can't sell the mills in this country or for export, and to keep buying the large crop, must sell hedges in the futures market to protect themselves. Then the speculator must enter the market and buy the contracts which the merchant sells, or the market would go to that low level at which the shipper could take on the crop feeling that he had eliminated all chance of the market going lower. Therefore let's don't cuss the speculator. If he is an evil, in my opinion he is a necessary evil.

It has been a pleasure to have been with you all tonight and I only wish that I could have handled my subject better. I thank you.

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Modern Methods of Handling Hydrogen Peroxide*

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THE purpose of this paper is to bring to your attention the manner in which some textile mills have simplified and eliminated some of the hazards connected with the handling of hydrogen peroxide by the installation of tanks, pipes and valves fabricated from corrosion resisting alloys; how such an installation effects certain economies by permitting the use of more dilute hydrogen peroxide solutions and the method of delivery of 25 volume hydrogen peroxide.

If a mill uses 100,000 pounds of 100 volume hydrogen peroxide, somebody must foot the freight bill for 72,444 pounds of water. If an equivalent amount is shipped at 25 volume, 344,614 pounds of water must be carried to yield the 27,556 pounds of actual hydrogen peroxide required. It is almost certain that the apparent discrepancy in the last two statements will be noticed. The question "Is 100,000 pounds of 100 volume equal to 372,170 pounds of 25 volume hydrogen peroxide?" has an affirmative answer. The explanation is simple: one gallon of 100 volume material is equal to four gallons of 25 volume, but one *pound* of the former is equal to but 3.7217 *pounds* of the latter. The difference is due to the fact that the specific gravities of the two concentrations are different, 1.1022 and 1.0255, respectively. The mathematically inclined will notice that the following is true: 1.1022 : 1.0255 :: 4 : 3.7217. It is hoped that this will clear up what is practically a universal confusion surrounding the *weight* relationships of this commodity usually given a volume designation.

It is rather obvious that barrels and carboys are not a very practical means of handling 25 volume peroxide outside of a very short trucking radius. Five years ago, we turned to tank trucks for delivery and wooden tanks for storage, to offset the freight disadvantage under which 25 volume hydrogen peroxide labored. Both truck and storage tanks have a special purpose liner which has been found satisfactory in the fifteen to twenty storage tanks in which it is used. More recently, with improved welding technique and the discovery that one of the 18-8 stainless steels is inert to 25 volume hydrogen peroxide and is not corroded by this solution, several installations of such tanks have been made. The foregoing should be enlarged somewhat to make its statement more understandable. With but two notable exceptions, metals in general exert a catalytic effect leading to the acceleration of hydrogen peroxide decomposition. The presence of only a few parts per million of common metals such as copper and iron in the hydrogen peroxide will lead to a decomposition many times as rapid as is normally encountered. The two exceptions are block tin and the particular 18-8 stainless steel found to be satisfactory. It is, therefore, obvious that both factors, inertness to 25 volume hydrogen peroxide and non-corrosion by this solution, are of equal importance. Stainless steel tanks have several advantages, they are much easier to erect, they are not subject to drastic expansions and contractions with changes in the weather and they require practically no servicing once installed. Wooden tanks must be tightened up every so often and the liner repaired or replaced whenever this is necessary.

The first thing to look for in choosing a tank site, is to find a location from which distribution to the desired points is possible by gravity flow through suitable piping. It is sometimes best to place the tank on the roof, sometimes outdoors on the ground and sometimes on a floor of the mill above the point of use. The illustrations are of an installation in a mill which bleaches raw stock. Taking advantage of the geography of the mill property, an outside location was selected such that with the tank empty, a seven foot head was obtained. With the tank full, the head was approximately twice that figure. The tank was prefabricated, the cover and the bottom each made of two pieces, butt-welded, the sides of five equal pieces also butt-welded. All welding was specified to be with columbium-bearing stainless steel coated electrodes with 0.08 per cent carbon maximum. Welding rod having the preceding set of specifications was found to yield a weld as inert to hydrogen peroxide as the stainless steel itself. In a recent article Critchett[1] mentions the difficulties encountered in welded structures fabricated of the 18-8 steels when subjected to corroding media. There was a loss of strength and ductility which came to be known as "weld decay." The phenomenon is now generally accepted to be inter-granular corrosion. The addition of titanium or columbium to 18-8 steels has eliminated this disadvantage so that welds are practically trouble-free. Several years of painstaking research are hidden behind these few simple statements concerning the tank and its fabrication. It was necessary to develop an accelerated corrosion test, then to examine scores of stainless steel alloys and finally, when the proper alloy had been found, to test the effect of hydrogen peroxide upon welds produced on this metal by the various rods available. Since the tank is outside, it was wrapped with

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**Technical Service Division, Warner Chemical Company.

[1]James H. Critchett—Chemical Industries, April, 1940.

building felt to insulate it and a weather tight shed was erected around it. Under normal use, this installation has proven adequate to withstand sustained temperatures in the vicinity of 10° F. and a low of 4° F. with no freezing of the peroxide.

The line connecting the storage tank with the measuring tank was made from 1¼ inch-16 gauge 18-8 stainless steel seamless tubing and was hung to the ceiling with sufficient slant that it would drain completely toward the measuring tank. The measuring tank is essentially a stainless steel box, fitted with a cover and approximately two feet on a side. The line from the storage tank is connected to the measuring tank through a quick opening gate valve and, by means of a graduated gauge-glass, any amount of hydrogen peroxide up to approximately 125 pounds of 100 volume equivalent may be run into the measuring tank by merely lifting this valve. A similar quick opening gate valve on the outlet side of the measuring tank feeds the measured quantity of peroxide into the bleach bath. Obviously, this is a very flexible arrangement and may be varied to meet almost any set of conditions. If the mill has been accustomed to measure their peroxide in gallons, the gauge-glass may be graduated in terms of equivalent gallons of 100 volume peroxide and the same is also true if the habit has been to add weighted quantities of the 100 volume material. Contrary to the case that is encountered when using other sources of available oxygen, no chemicals, acids, alkalies or other changes in technique are necessary.

The real beauty in such an installation as has just been described is the elimination of the labor connected with handling carboys and barrels. The hydrogen peroxide is delivered in a tank truck which contains a built-in centrifugal pump. An A.C. and a D.C. motor is mounted on either side of this pump in such a way that a common belt may be used to connect either motor to the pump. This makes it possible to use the electric power found in almost any plant to unload the tank truck directly into the storage tank without the complicated set-up which would be required were the motive power of the truck to be utilized for this purpose. From the storage tank, the hydrogen peroxide flows by gravity to the measuring tank and from that into the bleaching equipment. A mill has not yet been found in which it has been necessary to install a pump and experience indicates that such a possibility is extremely remote.

A daily inventory of the storage tank may be taken without going near this tank by employing a liquid level gauge known as a "Pneumercator." This device is a manometer containing mercury and connected to a long tube which extends from top to bottom in the storage tank. The pressure in the tube due to the depth of hydrogen peroxide over the bottom end of this tube is balanced against the height of the mercury in the manometer by means of a small hand operated air pump. The height to which the mercury rises when the pressure in the connecting line has been built up as far as it will go, is related to the specific gravities of mercury and hydrogen peroxide and the depth of peroxide in the tank. Of course, it may be graduated in pounds or gallons of either 25 volume or 100 volume equivalent.

Figure 1 is a photograph of an outside tank installation. The building surrounding the tank is, needless to say, weathertight and about all of interest in the photograph is the filling pipe which appears in the middle of the shed. The tank truck containing a load of hydrogen peroxide is backed up to this fitting and after connecting the proper motor to the electrical current supply and the hose to this fitting, unloading is merely a matter of turning a switch. Depending on the height of a tank above that of the tank truck, 1,700 gallons may be discharged in from 35 minutes to one hour. To make certain that no insoluble foreign matter gets into the tank, the discharge hose from the tank truck is equipped with a 100 mesh stainless steel screen.

Figure 2 is a close-up of the shed in which the tank and insulating material surrounding the tank may be seen. A somewhat better view of the filling connection also shows.

Figure 3 is a view inside of the shed looking toward the door. The cover in the center may be removed for inspection of the tank. The filling pipe appears to the right and the small tube on the left is a line which connects with the Pneumercator previously described. Some of the details of the fabrication of the tank may be seen in this illustration.

Figure 4 is a view of the measuring tank. The gravity feed line from the storage tank appears in the upper left-hand corner and the manner in which the quick-opening gate valve is installed, shows.

Figure 5 is a close-up of the measuring tank from the same side as the previous illustration and shows the graduated gauge-glass used to determine the amount of Hydrogen Peroxide to be added to the bleach bath.

Figure 6 is a view of the measuring tank from the opposite or discharge end and, as in previous photographs, the rugged construction employed may be seen.

Figure 7 is a view of an inside tank installation. This was one of our first all-metal tank installations and is

Fig. 3

Fig. 1

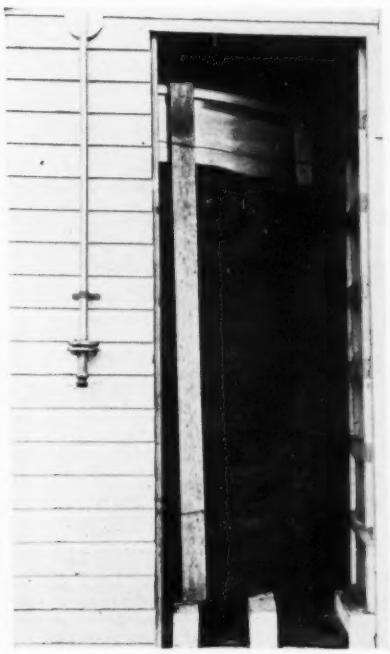

Fig. 2

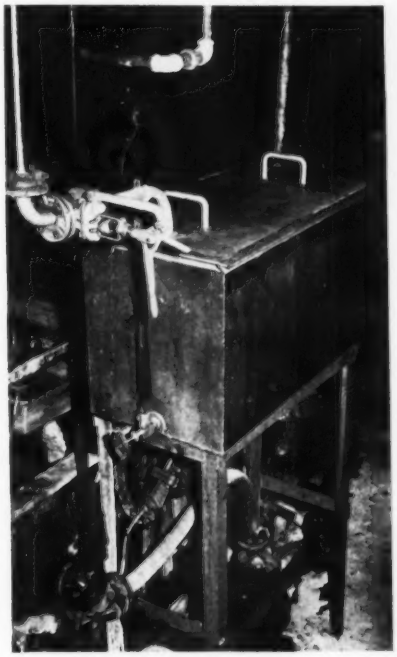

Fig. 4

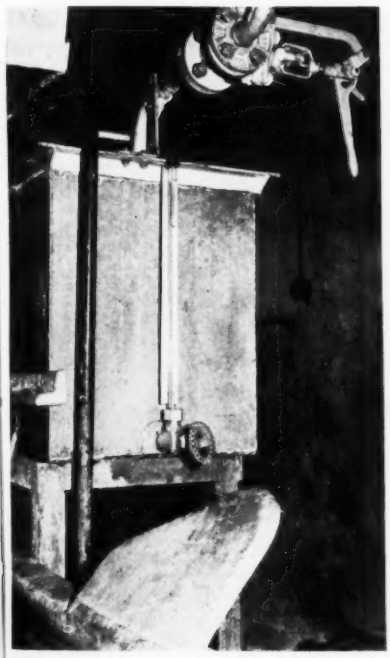

Fig. 5

Fig. 6

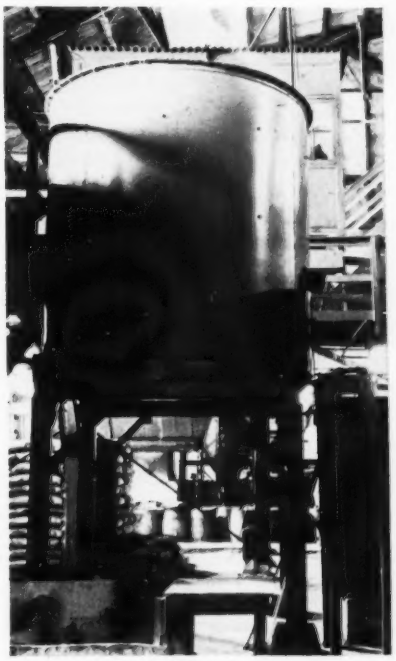

Fig. 7

fabricated of ordinary cold rolled steel with a block tin lining 1/24th of an inch thick. This tank has proven satisfactory in every way but since the development of the welding technique previously mentioned, no similar installations have been made.

May I say in conclusion that our experience with lined tanks in our own plant has been satisfactory principally because we have had sufficient experience to service them adequately. Very few textile mills have a sufficient number of tanks to make it worth their while to maintain a personnel trained to service such equipment. We have adopted the welded stainless steel tank because it is simple to erect, requires no servicing and is inert toward Hydrogen Peroxide solutions.

MEMBERSHIP APPLICATIONS

Senior

Victor John Krukonis—Assistant Dyeing Overseer, Wood Worsted Mill, American Woolen Co., Lawrence, Mass. Sponsors: F. A. Dushame, G. E. Herzog.

Charles G. Krebs—Boss Dyer, Forstmann Woolen Co., Garfield, N. J. Sponsors: W. von Bergen, O. H. McClay.

Associate

F. N. C. Jerauld—Salesman, Buffalo Electrochemical Co., Buffalo, N. Y.

Edward R. Ravenel—Salesman, Myles Salt Co., Decatur, Ga.

Student

Raymond G. Boule—Lowell Textile Institute. Sponsor: L. A. Olney.

Leonard R. Corcoran—Lowell Textile Institute. Sponsor: L. A. Olney.

George J. Mandikos—Lowell Textile Institute. Sponsor: L. A. Olney.

Robert W. McCartney—Lowell Textile Institute. Sponsor: L. A. Olney.

Arthur J. Moreau—Lowell Textile Institute. Sponsor: L. A. Olney.

Lathrope A. Schiffer—Lowell Textile Institute. Sponsor: L. A. Olney.

Stanley Szopa—Lowell Textile Institute. Sponsor: L. A. Olney.

Frederick A. Walker—North Carolina State College. Sponsor: A. H. Grimshaw.

Sheldon W. Taylor—Bradford Durfee Textile School. Sponsor: L. B. Coombs.

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the American Dyestuff Reporter any vacancies which may occur in their business.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

NOTICE TO EMPLOYERS

Complete personal histories and employment records of the following applicants are on file at the office of the American Dyestuff Reporter.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE SECRETARY OR THE AMERICAN DYESTUFF REPORTER AT ONCE.

A-1

Education—Graduate textile chemistry and dyeing course, Lowell Textile Institute, 1932. Special course in colloid chemistry at M.I.T.

Experience—Library work in spare time while attending school; five years as assistant chemist with knitting mill, duties consisting of testing and grading silk, testing of oils, soaps, dyes, finishes and other chemicals, making up specifications for various lines of hosiery and checking finished product, keeping a check on production costs, control of waste and irregulars, checking competing products and carrying on research to improve product and reduce costs.

Woman; age 30; references.

A-B-7

Education—Evening school in textile dyeing and chemistry.

Experience—Dyehouse laboratory for 2 years. Foreman dyer and finisher on hosiery for 9 years. Experience on ribbons also vat dyes on rayon and silk skeins. 2 years assistant to superintendent. Desires position either in demonstrating and sales or dyer; New York Viciniy. Age 33; married.

A-B-8

Education—Graduate Chemist.

Experience—Print superintendent, colorist; eleven years' experience in all types of fabrics, specializing on rayon; 8 years' dyestuff laboratory and demonstrating. Excellent references; age 37; married.

A-B-9

Education—Bradford Durfee Textile School, 1918, chemistry and dyeing course.

Experience—Dye application, textile and color chemist; good general factory, laboratory and office experience; accustomed to assuming responsibility; handled all types of help; purchased chemicals, dyes, etc.; executive ability; good personality.

Age 42; American, married; will go anywhere for interesting work; references.

A-B-10

Education—1 year of textile chemistry, day course, Philadelphia Textile School; also business course.

Experience—3 years as apprentice in weaving mill in Germany, office and stock room, general clerical work, practice in all departments of cotton manufacture, dyeing, bleaching and finishing of cotton-rayon mixtures, piece and package processing; several mos. in laboratory of German dyestuff manufacturer, dyestuffs and assistants and their application, vat and naphthol dyeing.

Age 20; will go anywhere in U. S.

A-B-11

Education: Graduate chemist. Correspond and converse German, some French.

Experience: 3 years dyer; 4 years dyestuff testing, troubleshooting, purchasing; 4 years demonstrating, consulting, and supervising for large dyestuff manufacturer. Thoroughly experienced on rayon, cotton, silk, acetates, printing, vats. Fullest references as to character and ability. Seeks position as technician, consultant, or superintendent with reliable dyestuff sales organization or dyehouse. Age 33, married.

A-B-12

Education—Philadelphia Textile School (Evening), Chemistry and Dyeing, Quantitative and Qualitative Analysis.

Experience—Two years in yarn office, making wool stock blends. Last 6 years in dyehouse, 4 years as kettle hand, 2 years in piece dye work. Worked on yarn, raw stock and piece goods; has been dyer on union piece goods, cotton, rayon and wool, leaving wool white; also worked on all wool fabrics and woolen cross dyes; also considerable laboratory experience doing laboratory dyeings and extraction work. Seeks position as dyer or laboratory technician.

Age 30; married; references.

A-B-13

Education—B.S., Chemical Engineering, Oregon State College, 1926.

Experience—First experience in dry cleaning plant; few months as sampling and control chemist with potash and chemical company; two years in dry cleaning plant, all phases of work; few months on routine and special analyses, plant problems, special studies and research for gas and electric company; 10 years teaching experience on textile chemistry, dyeing and textile testing covering all general and special courses in this field; consultant work with various mills. Seeks position in textile chemistry or dyeing.

Age 37; married; will go anywhere; references.

A-B-14

Education—Graduate of New Bedford Textile School, chemistry and dyeing course.

Experience—Two years in dyeing filament rayon skeins; seven years general laboratory work in large print works; four years overseer of package dyeing of cotton and spun rayon with all types of colors. Plant liquidating; must find other employment

Age 34; married; references.

A-B-C-4

Education—Educated abroad.

Experience—Twenty years experience in the textile field as bleacher, dyer, finisher and chemist. 16 years in charge of dyestuff laboratory of large dyeing plant, 4 years as chief chemist with large bleachery. Has tested dyestuffs, and chemicals used in the textile field and has manufactured soaps and textile specialties. Has handled all textile fibers; bleaching, printing, dyeing and finishing same. Has done pigment and lacquer printing, waterproofing and fireproofing. Reason for leaving last position was due to business conditions.

Age 41; married.

A-B-C-8

Education—B.T.C., 1933, Lowell Textile Institute.

Experience—5 months as rayon slasher tender; 8 months color matching, dye testing and analytical work; 5 years with large print works in rayon finishing department, laboratory, color matching, dye testing, assistant rayon dyer. Seeks position as rayon dyer, assistant dyer, or any job in a rayon dyeing and finishing plant. Age 29; single.

A-B-C-9

Education—Lowell Textile Institute; chemistry, dyeing and textile finishing.

Experience—Twelve years head dyer in hosiery mills. Dyeing all types of fibers and in combination. Knowledge of all dye applications. Matching and formula making. Charge of every department in a hosiery mill except fixing machinery. Has done jigg work on cottons and rayons. Desires position in hosiery, or in any field. Would like to work as an assistant to head dyer in a woolen or rayon mill. Age 42; married. Will go anywhere in the United States.

A-B-C-D-1

Education—Lowell Textile Institute, Bachelor of Textile Chemistry; Lowell Textile Institute (Evenings), 2 years D. C. Electricity; 2 years A. C. Electricity.

Experience—Six years as chemist and assistant dyer with a large organization. Specialized in dyeing, finishing, bleaching and drying of woolens, worsteds, cottons, rayons and unions in the piece. Some sales experience. Desires position as chemist, dyer, finisher, bleacher or sales. Age 30; American citizen; Married.

A-B-C-E-1

Education—3 years Chemical Engineer major in college; honor graduate Philadelphia Textile School, chemistry and dyeing course.

Experience—Ten years experience as chemist, colorist, technical director in bleaching, dyeing and finishing of cottons and rayons. Also one year's similar experience in South America. Instructor of textiles and textile chemistry in state vocational school, 2 years. Married; age 32; references; will go anywhere.

A-B-C-F-1

Education—Textile Institute course in Dyeing and Chemistry; Extension work at Brown University; Executive Training with Alexander Hamilton Institute of New York, N. Y.; working knowledge of one foreign language.

Experience—Dyeing executive on all types of textiles including stock, yarns in the skein, warp and package, and piece goods. Thorough knowledge of all classes of dyes and dyestuffs and their successful practical application in the plant. Extensive knowledge of all types and makes of equipment for dyeing, bleaching, mercerizing and finishing. Laboratory practice in testing, standardizing, purchasing, costing, planning and checking processes, and market analysis. Good manager of personnel for better efficiency in retaining friendly labor relations. Conversant with modern methods for quality production economically secured through better coordination and correct alignment in processing, on cotton, viscose and acetate rayon, silk, wool, worsted, and mixtures. In excellent mental and physical health; excellent references.

A-B-D-1

Education—Special courses in general chemistry.

Experience—Twenty-nine years' experience in application and standardization laboratories of various dyestuff manufacturers. Well versed in the application of dyestuffs to different textile fibers, i.e., wool, cotton, rayon, silk, acetate rayon and unions, using direct, acid, diazo, sulfur, acetate rayon, chrome and after-treated direct dyestuffs. Six months' actual dye house experience on jigs, open boxes, padders, bleaching and mercerizing. Experience demonstrating sulfur and direct colors at various mills. Seeks position as textile colorist in application laboratory and demonstrator.

Age 46; single; references.

A-D-1

Education—Graduate of New Bedford Textile School, 1936.

Experience—Chemist for woolen mill 7 months; technician and salesman for chemical company 1 year and 9 months. Seeks position as salesman or in purchasing department.

Will go anywhere; married; references.

B-5

Education—High School and Textile School Graduate.

Experience—Twelve years overseer of dyeing on directs, vats, naphthols, sulfur, basic and developed colors. Also experienced bleacher. Age 40; married; references.

B-6

Education—Graduate New Bedford Textile School; also post graduate work in advanced microscopy and rayon testing.

Experience—Five weeks in color shop of print works. Wants position in anything associated with textile chemistry, dyeing, finishing and testing.

Single: age 21; references.

B-D-1

Education—General education in England. Chemistry and Dyeing Courses at Huddersfield Technical School.

Experience—Has been a superintendent of dyeing since 1911. Has had experience in worsted mills, hosiery mills and woolen mills. Congenial, sober and reliable. Married; references; age 53.

C-1

Experience—Thirteen years' experience in finishing all types of rayon fabrics, including spun rayons and blends. Last position also included supervision of the worsted dry finishing department. Reason for leaving last postiion: liquidation of company.

Age 39; married; will go anywhere; references.

F-1

Education—Two years high school; 6 years evening engineering school; 1 year evening textile school; 1 year industrial management; course in accounting.

Experience—Ten years in an executive capacity in full fashioned hosiery manufacturing business. Familiar with entire manufacturing procedure, finishing dept., dyehouse and office. Specialized in finishing dept. and has good eye for color, finish and quality. Had responsibility of all orders going through mill, stock, grey goods and traffic. Five months in New York sales office. Gets along well with people and contact with employees and customers has always been satisfactory. Previous to hosiery experience was in a mechanical business for 17 years.

43 years of age; single, in good health; will go anywhere.

Unemployment Register

Members of the association who are without employment may obtain from the Secretary, or the American Dyestuff Reporter, application blanks for the Unemployment Register. Personal histories and employment records of applicants may be examined by prospective employers.

Twentieth

ANNUAL MEETING AND CONVENTION

OCTOBER 18TH AND 19TH, 1940

HOTEL COMMODORE

NEW YORK CITY

OCTOBER 20TH, AT N.Y. WORLD'S FAIR

General Chairman

PATRICK J. KENNEDY

Auspices of

NEW YORK SECTION

WALTER M. SCOTT

Chairman, Technical Program Committee

THE chairman of the technical program committee for the twentieth annual meeting is Dr. Walter M. Scott, Chief of the Cotton Chemical Finishing Division of the Southern Regional Research Laboratory being established by the U. S. Department of Agricultural. Dr. Scott is especially well suited for this position as he has been a very active member of the research and year book committees for many years as well as a member of the council. He has a very interesting program in process of arrangement, further details of which will appear in the next issue.

AMERICAN
DYESTUFF
REPORTER

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Vol. 29 July 8, 1940 No. 14

PUBLIC OPINION

THE strength of popular public opinion was responsible in no small measure when Wendell L. Willkie, a man without the backing of an organized political machine, was nominated by the Republicans as their candidate for president. It would have been impossible for this to occur without the unprecedented strength of the public demand which forced the machine politicians to nominate the former Democrat. The determination of a large number of the citizens to have this man nominated had its effect on the delegates assembled in Philadelphia.

Now, if ever, the Republicans have a chance to regain much of their former political significance. They had been looking for a man strong enough to stand up to Roosevelt and it certainly looks as if they now had that man. Whether Roosevelt will run again or not will be determined later but if he does run against Willkie we can be assured of a strong and vigorous campaign. The Republican party was in need of new blood and energetic leadership to carry them out of the state of lethargic indifference in which they were viewed by many. Willkie is a man of strong determination and commanding personality and can bring about this needed revision. We have ample evidence of his qualities of appeal to the public in the tremendous popularity he attained in a few months, previous to which he was practically unknown to the average person.

Just what brought about this burst of enthusiasm for the man is difficult to say. Certainly it was not built up by a well organized political body; rather, the machines were working against him. It was also demonstrated that apparently the people cared little for the fact that he had previously been of another political party, or that he was identified with the utilities, or that he was a believer in Hull's reciprocal trade agreement program. Neither did they seem to care that he had not worked himself up through the ordinary channels of political advancement. The people wanted a candidate who had energy, courage, foresight and intelligence and they made their voices heard. Whether or not Willkie could win in a campaign waged against Roosevelt we, of course, do not know, but he is evidently capable of waging a spirited battle for the country's highest office. We doubt if the Republicans would have had as good a chance with any other candidate.

Willkie is in rather a unique position to carry on his campaign for the presidency. He is not obligated to any machine or political boss for his nomination and the politicians will have to follow his lead and depend upon him. Regardless of a person's political affiliations or inclinations one must admit that the miracle of a Republican convention nominating a former Democrat, in opposition to the wishes of its political leaders, is a victory for public opinion and provides a needed stimulus to the democratic form of government which has fared so sadly in other parts of the world.

A really big man was needed by the Republicans and he appeared. Seldom has popular approval for a man developed with the spontaneity that characterized Willkie's rapid rise to public prominence. It is apparently fortunate for the Republicans that public opinion forced the nomination of Willkie. He seems to be the only man forceful enough and colorful enough to give this party a fighting chance in the coming presidential race.

We do not intend to take sides in political campaigns but we believe it essential to our form of government to have a strong second party and for this reason we are pleased to see the Republicans pick an outstanding person for their candidate. We are going through a particularly trying time and cannot afford to have one party monopolize the political picture. Democracy thrives on two parties of near equal strength and effectiveness. Willkie gives the Republican party the needed impetus to make it a major political factor again.

We are going to witness an extremely interesting and powerful campaign in the coming months. The revitalized Republicans and the already strong Democrats will provide the basis for one of the most colorful political battles of our time. Not the least amazing part of it will be the fact that one of the candidates is a stranger to politics who rode on the crest of a wave of popular approval to the candidacy of the Republican party.

OBITUARY

WILLIAM W. BUFFUM

WILLIAM WALLACE BUFFUM, treasurer and director of The Chemical Foundation, Inc., 654 Madison Avenue, New York, N. Y., died at the Mountainside Hospital in Montclair, N. J. on June 22nd after a brief illness of a heart ailment.

Mr. Buffum was born at Friendsville, Pa., on August 25, 1888. From 1917 to 1921 he was chief accountant in the Washington office of the Alien Property Custodian. Since 1921 he had been a member of The Chemical Foundation. He took an active interest in the furtherance of chemical education in this country, in the organization of the American Institute of Physics, and in the development of newsprint from Southern pine. He was also greatly interested in the utilization of chemistry in the fight against various diseases, such as cancer, tuberculosis, etc.

Through his connection with The Foundation, he became business manager of several periodicals, including The American Journal of Cancer, Sewage Works Journal and The Journal of Clinical Investigation.

Mr. Buffum was a member of the Chemists' Club, Montclair Golf Club and Beacon Hill Golf Club.

He leaves his widow, two sons, a daughter, his mother, and two brothers.

• NATIONAL CHEMICAL SHOW

With 43 per cent of the total space available already under contract, the show committee of the first annual National Chemical Exposition, sponsored by the Chicago Section of the American Chemical Society, to be held December 11 to 15 at the Stevens Hotel in Chicago, is said to be facing the acute problem of not being able to accommodate all firms that plan to exhibit at the big show.

"It seems apparent that we have miscalculated the possibilities for the sale of space at this our first exposition," said Dr. R. C. Newton, chairman of the show committee. "We had anticipated that the available 32,000 square feet would be adequate to meet all demands, but inquiries indicate that it will be insufficient to take care of all firms that would like to be represented.

"Up to the present we have placed no restriction on the amount of space requested by single exhibitors, but the show committee is seriously considering the necessity of setting a limit in order that many firms will not be disappointed."

Dr. Newton reports that 68 per cent of the space assigned has been contracted for by firms that manufacture chemicals or laboratory apparatus related to chemical research. The other 32 per cent has been allotted to equipment manufacturers.

Headquarters of the National Chemical Exposition are at 110 N. Franklin St., Chicago, Ill.

• LABORATORY OF MICROCHEMISTRY

The Laboratory of Microchemistry, 366 5th Ave., New York, N. Y. announces a major expansion of space and facilities. Doubling of space according to the Director, Dr. Carl Tiedcke, has been made necessary by the increased demands for industrial and applied microchemical services. Identification and tracing the source of foreign specks, trace materials, etc., in products is one of the services for which there has been a large demand. In addition to usual and unusual elementary analyses, particular attention is given to biochemical and industrial research problems. Typical procedures such as microdistillations are performed with samples as small as 0.5 cc. and specific gravity determinations are readily made on 0.1 cc. samples, it is stated.

• CHEMICALS FOR COTTON

The cotton textile industry looks to the chemical industry for new products useful in finishing, asserted Samuel Lenher, Technical Manager of the Fine Chemicals Division of the Du Pont Company, in a paper read at Waco, Texas on June 29th, before the Cotton Research Congress.

"In 1914," said Dr. Lenher, "there was, practically speaking, no dyestuff industry in the United States. In 1938 the United States Tariff Commission figures indicate the sales of dyestuffs in the United States were 87,000,000 pounds. The imports were 3,150,000 pounds.

"The dyestuff industry is extremely complex and there are manufactured today in the United States approximately 2,000 to 2,500 individual dyestuffs of all shades and degrees of fastness. It can truthfully be said that the United States today is self-contained as far as dyestuff requirements are concerned.

"Research in the dyestuff industry is continually going on, and the industry as a whole has averaged 25 to 50 new dyestuffs a year, each one endeavoring to satisfy some more exacting requirement of the textile industry and constantly tending toward improvement either of fastness or of application technique. The net result of all these developments is that today the consumer gets better quality for his money than ever before."

Dr. Lenher, also discussed advances in the development of surface-active agents, synthetic resins, water repellent and fire retardant finishes, organdy finishing, shrink proofing and mildew proofing.

"These advances," concluded Dr. Lenher, "made during the last quarter century, make it clear that active research has led to the development of new and improved cotton finishes. This research has been actively supported by the American chemical industry, and by American and foreign textile concerns. For the most part, the cotton textile industry looks to the chemical industry, and probably rightly so, for new products useful in finishing."

• PHOENIX RELEASES

Phoenix Color and Chemical Co., 24 Van Houten St., Paterson, N. J., announces release of the following new dyestuffs:

Benzaphen Violet BCW—a direct color which leaves acetate rayon pure white, making it very suitable for dyeing rayon and acetate combination cloth. It is said to have good dischargeability, wash, light, acid and alkali fastness. It is slightly sensitive to hot ironing, but the original shade returns on cooling. The solubility, penetration and leveling properties are said to be excellent. This product can also be used in the padder.

Benzaphen Bordeaux BCW—a direct color which leaves acetate rayon very white and is recommended for dyeing rayon and acetate combination cloth. It is said to have very good acid, alkali, light and wash fastness and discharges to a pure white. The wash fastness is further improved by aftertreatment with formaldehyde. The solubility, penetration and leveling properties are said to be excellent. The product can be used in the padder.

Phenaldehyde Blue Green B—a direct, bright blue green which is said to be rendered fast to washing on formaldehyde aftertreatment. This product is further said to be fast to light, acid, alkali and ironing. It penetrates well and discharges to a pure white. It is also said to be quite fast to washing without aftertreatment. This color is also useful in dyeing acetate and viscose rayon combination cloth leaving the acetate quite white.

• HERCULES' APPOINTMENTS

Hercules Powder Company announces the appointment of A. E. Forster as assistant general manager of the Naval Stores Department.

Mr. Forster joined Hercules in 1925 as a member of the Explosives Service Divi-

sion on the West Coast. In 1935 he became assistant superintendent of the Carthage, Missouri, plant, and assistant manager of Birmingham, Alabama, sales office in 1937. Appointed manager of the Service Division of the Explosives Department in 1939, Mr. Forster served in that capacity until his appointment in January, 1940, to the position of assistant general manager of the Explosives Department.

Mr. Forster will assume his new duties on July 1 and will continue to make his headquarters in Wilmington.

• BOYE APPOINTED

The United States Testing Company has announced that Frank G. Boye, General Manager of the Yarn Division has been designated, in addition, as Manager of the Storage Department in Hoboken to assume active direction of the Department, Monday, July 1.

Mr. Boye has been a member of the Company's executive staff over 20 years and succeeded his father as Manager of the Silk and Yarn Laboratories in the fall of 1924. He is thoroughly informed by years of experience in the inspection, testing, care and handling of raw silk and yarns and is prepared to render individual service in connection with transportation and shipping problems.

• NOPCO 1556-X

Especially prepared for the treatment of cuprammonium rayon and other synthetic yarns for full fashioned knitting, a new neutral oil of low viscosity, tradenamed NOPCO 1556-X, was announced recently by the Technical Service Department of the National Oil Products Company, of Harrison, N. J.

It is claimed by laboratory chemists that NOPCO 1556-X imparts added softness and lubrication to these yarns, assuring evenness of stitch formation in full fashioned knitting. They point out that the new oil is highly resistant to oxidation and rancidity and that it may be applied without any additional preparation.

• POLYVINYL ACETATES

A new group of resinous emulsions, the polyvinyl acetates, is announced by The R. & H. Chemicals Department, E. I. du pont de Nemours &Company. Polyvinyl acetate resins in solid form and in solution covering an exceedingly wide viscosity range, are also available, a company statement discloses.

Properties of the new emulsions suggest their application in general adhesive use, printing inks, textile sizes, textile stiffeners, plywood adhesives, cement for padding materials, priming coats for ceramic bodies, and sealing agents for tile and concrete.

The emulsions are said to be distinguished by excellent stability, lack of color, and high solids content. They are described as free-flowing fluids, milk white in color, stable to dilute acids and alkalies, containing approximately 60 per cent solid polyvinyl acetate resin finely dispersed in water. They dry to hard, thermoplastic, heat-sealing, colorless films.

The emulsions are said to be excellent adhesives, having strong bonding action between a wide variety of materials such as metals, cellulose products, leather, cork and cloth. They may be easily diluted to any desired concentration in water and are miscible with rubber latex, starch and certain wax emulsions. Softening agents for elastic bondings may be added directly to the aqueous emulsion.

Because polyvinyl acetate emulsions contain only water and resin, it is possible to avoid the use of flammable, expensive, organic solvents, it is stated.

• CHLORINE AFFINITY OF FINISHES

The Calco Chemical Division of the American Cyanamid Company has retained the laboratory facilities of the American Institute of Laundering to check on the possible chlorine affinity of the various finishes which they are now selling to the textile trade. This move came to light when the American Institute of Laundering recently requested finished samples of goods from various mills using Calco finishes.

The present work is being done on resins. Calco is convinced that synthetic resins have a definite place in the finishing of textile fabrics and intends to keep them trouble free, so that they can quickly demonstrate their utility.

The Calco method of determining the behavior of their resin finishes is to first check them in the laboratory, and then to secure samples of goods treated by various mills, which will be given actual laundering tests to make sure that the commercial application of these resins causes no trouble.

• HALLMARK TUBING

Stein, Hall & Co., Inc., 285 Madison Ave., New York City, has issued an illustrated folder describing Hallmark Burlap Tubing as a new, streamlined wrapping technique which is said to save time, money and material for packing and shipping departments. This product is being used successfully for wrapping textiles, carpets, rugs, cordage, rubber hose, belting, blankets, felt, asbestos, steel wool and other products shipped in rolls.

Hallmark Burlap Tubing is a spirally sewed Burlap in continuous lengths made from standard widths of cloth. Its use is said to eliminate time-consuming measuring and sewing as it fits easily over the product. The construction permits a two-way stretch so that within reasonable limits the same size can be used for packages of different diameters.

Copies of the folder are available upon request.

• CIBA REVIEW

Ciba Review, Number 33, for May, 1940, has recently been issued. Featured in this issue is the subject: "Bark Fabrics of the South Seas." The titles of the articles which carry out this theme are as follows:

The Islands of the South Seas; The Geographical Extent of the Use of Bark Fabrics; Bark Cloth in the Reports of the First Explorers of the South Seas; The Manufacture of Bark Cloths; The Use of Bark Cloth; Notes; Scientific Notes.

Many interesting and instructive illustrations are used throughout.

• TEXTILE MERCHANDISING AND MARKETING COURSE

H. R. Mauersberger, in charge of the Evening Textile Courses at Columbia University, wishes to announce the addition of a new course on the subject of "Merchandising and Marketing of Textiles" to be given next Fall by Dr. S. J. Kennedy, director of Market Research of Pacific Mills. He is the author of "Profit and Losses in Textiles" published by Harper and Bros. in 1936 and "Textile Markets" published by the National Bureau of Economic Research in 1939.

The course will be a study of the problems dealt with by the textile merchants or the executive in charge of merchandising in a cotton, wool or rayon converting or mill organization such as: the structure of the textile markets; their inter-relations in the flow of goods from raw material through grey goods, finished goods and fabricated products to the final distribution; the pricing process in relation to fluctuating raw material prices and stable retail prices; inventory management in relation to seasonal and cyclical fluctuation; and related subjects. Students will be encouraged to follow price movements of textile products in which they are interested. The course is recommended to those training for junior executive merchandising positions in textile companies.

The course consists of 15 lectures and will be given on Tuesday evenings from 7:30 to 9:20 P. M. For further information address the Registrar of Columbia University, 116th St. and Broadway, New York, N. Y.

Hygienic and Technical Aspects of

Water Repellent Clothing

LEO STEIN, Ph.D.

THE importance of porous-water proof, or more precisely water repellent fabrics is becoming more and more universally recognized. Therefore, a comprehensive study of these materials will promote better understanding among manufacturers of the chemicals, manufacturers of cloths and clothing, processing men, hygienists, sellers and consumers. Above all, clothing should compensate for man's inability to withstand climatic and other external influences. Unclothed man is less well armed to meet many conditions than most animals. In this connection we may cite the ability of animals to combat winter cold by re-enforcement of their natural means of protection. Transplantation of certain animals from their usual climate into a new one causes an adaptation, e.g., the Merino loses its wool when transferred to the Congo or Sudan, and its skin becomes similar to that of a greyhound. By virtue of his superior intellect man has been able to realize artificial protection through clothing. This, together with proper food and shelter, renders possible the successful adaptation to the most variegated geographical regions.

The human body is surrounded by a vapor atmosphere which is incessantly renewed, thanks to perspiration, and which comprises two different mechanisms: One is the insensible perspiration, which means vaporization of water from the epithelial layers of the skin; the other is the excretion of liquid water by the activity of 2½ million sweat glands. The most important purpose of this function is the regulation of body heat; the maintenance of a constant temperature of about 98° F. is essential for life. This heat is engendered by the combustion of food material by oxygen, obtained by respiration. Depending upon food intake and body activity, body temperature would vary if the balance between production and dissipation of heat was not maintained by the heat regulating mechanism. One of the main processes available for heat dissipation is represented by the evaporation of sweat. From 77° F. upwards water elimination by the sweat glands increases considerably. Wind reduces perspiration markedly at 70-95°; this is due to the fact that constant renewal of air increases loss of body heat by conduction, and that there is not so much need for heat dissipation by evaporation. Hot wind, however, augments the evaporation of water.

The humidity of the atmosphere may be expressed as grams per cubic meter, or as vapor pressure, or as relative humidity, i.e., the ratio between the actual humidity and the maximum humidity at the given temperature, or as saturation deficit, i.e., the amount of additional water which the atmosphere is able to absorb at a given temperature. The intensity of evaporation is for instance proportional to the saturation deficit. At constant temperature an increase of atmospheric humidity causes the water elimination to decrease and not the opposite as one might conclude from the presence of sweat, when the surrounding air is hot and damp. This is because in that latter case super-saturation of the air occurs near the body surface and liquid water precipitates on the skin.

As to the chemical nature of sweat, we might recall that this secretion represents a dilute aqueous solution of acid reaction, resembling qualitatively the urine of a subject on meat diet. The dry residue amounts to 0.5 to 2.5 per cent. Sodium chloride is the most important among the mineral constituents. The specific gravity decreases if the total volume of sweat increases. The amount of water lost through the skin in 24 hours varies between 900 c.c. and 2,500 c.c., depending on different factors especially muscular activity. Carbon dioxide is present in an amount of about 5 grams, which increases during hard labor.

High relative humidity associated with high temperature and an absence of wind is unfavorable to the organisms, because under these circumstances conduction and radiation of heat from the body are very little and loss of water through the skin is much interfered with. This inability of the body to dissipate its excess heat results in symptoms as headache, dizziness, vomiting, fainting, convulsions, possibly a heat stroke. These symptoms are favored in their appearance by intense physical labor.

Having the preceding points in mind, we can understand the requirements to be fulfilled by proper clothing. The importance of clothing, besides its esthetic and certain other aspects, is to serve two purposes: on one hand it should insulate the organism and protect it thus from too great a heat loss and from noxious atmospheric influences; on the other hand it should prevent heat stasis in the organism, by permitting the escape of excess heat and of water vapor.

Cotton, linen and woolen clothing materials consist of

fabrics obtained either as a rectangular combination of warp and filling, or as fabrics with stitch formation. Yarns result from spinning of cotton and flax fabrics and of wool hairs; they may be used also as threads, obtained by plying two or more single yarns.

The essential feature of clothing material is its containing pores represented by interstices filled with air. These act as capillaries, the walls of which are vegetable fibers or animal hairs. Air, fibers and hairs are poor conductors of heat, hence they act as thermic insulators. The idea of clothing, according to hygienists, is to maintain in all climates and latitudes a tropical temperature about the organism. Porous clothing transmits air from the outside through the larger channels to the skin. Air also streams to the body along those parts of clothing which do not close tightly. On the other hand, breathing, moving and differences of temperature press air through the same passages from the inside to the outside.

The permeation of water vapor through clothing is regulated by the adsorbing property of the fibers and hairs and is influenced in its rate by the size of the openings and the conditions of temperature and pressure. This process is essentially different from the passage of air through the pores; the latter obeys to the law of real gases.

The previous paragraphs show the important role which clothing plays in aiding and completing the skin in its vital functions. (In this paper only cotton, linen and woolen clothing have been considered, silk and rayon are not included for extraneous reasons.)

We are able to modify the important properties of clothing in a manifold way. By varying the thickness of the cloth, the closure of interstices, the turn of the single and plied yarns, the kind of texture and material, and the number and kind of clothing pieces.

The same cloth cannot absorb sweat in liquid form and repel rain. Therefore, we must use a wettable, porous piece in contact with the skin so that in case of heavy perspiration the fluid may be easily absorbed and through the existence of a highly developed surface (the individual fibers) the intensity of evaporation may be increased. The piece protecting from rain is to be applied out of reach of the sweat.

It is often mentioned in the literature that water proofing of cloths results in a decrease of their porous property. In order to show the non-foundation of this assertion, the following points may be cited. If the permeability of clothing with regard to sweat has been measured in the past, the rate of permeation for air was determined at a certain pressure. Such a method, disregarding the conditions of adsorption and desorption, is not admissible. As mentioned above, water vapor shows fundamentally different behavior from that of air in permeating cloth. To equalize the permeability toward water vapor to that toward air would mean the same as to determine the rapidity of drying of linen by measuring the amount of air which passes across the drying room at a fixed pressure. Besides other causes of error, the distribution of the linen, i.e., the drying surface would not find a correct expression in the total resistance. The fact that carbon-dioxide and certain other gases are excreted by the skin in very small amounts compared with that of the excreted water, cannot justify either to equalize the permeability toward air with that toward water.

It is known that textile fibers and hairs contain a certain amount of water depending on the relative humidity of air. In order to assure uniformity in the trade of yarns one has agreed upon a certain allowance of water to the dry weight of the yarn. That is for cotton 8.5 per cent, linen 12 per cent, and wool 18.25 per cent.

When dried cotton is brought into a room with a certain relative humidity we can state through successive weighings that the moisture of the cotton increases until a certain value is reached which is not passed. If the relative humidity of the atmosphere is increased, the moisture rises until a new equilibrium is attained. Vice versa, lowering of the relative humidity of the surrounding atmosphere causes the cotton to lose water. During these changes the external appearance of cotton is not altered. The water is bound to the cotton substance by adsorption. However, on measuring the temperature one finds that heat is produced through adsorption and consumed through desorption of water.

The following experiments serve to illustrate the permeation of clothing by water:

A crystallizing dish of 1¼ inches in height and 2 inches in diameter is filled with water up to 2/3rds of its height. The dish is covered with a cloth which is fastened around the rim. The whole is immediately weighed. After a certain time one can demonstrate a diminution of the weight. The difference represents the amount of water which has permeated through the cloth in invisible vapor form.

Such a permeation of water occurs even, although more slowly, if the air above the cloth is quite immobile. The process continues as long as the atmosphere overlying the cloth is not completely saturated with humidity. It is to be noted that evaporation from an uncovered dish may be several times more intense than from the covered dish, particularly if the air above is in movement.

Various cotton and woolen cloths, used for raincoats and similar purposes, which differ as to kind and closure, show relatively little differences from the second hour after the onset of the experiment.

However, they behave much differently, if changes occur in the outer conditions, particularly concerning temperature and state of movement of the surrounding air, but also humidity and atmospheric pressure.

Comparing porous-water repellent cloths with simply dyed non-water proofed cloths, one notices practically no differences as to the amount of water permeating the cloth under the same conditions.

Moreover the water proofing is so perfected now that the transmission of air is not decreased either. Other methods of testing and results found by the author could also be mentioned. Here, we cite only one experimental

fact in order to illustrate the essential difference between the permeation of water vapor and that of liquid water. Two waterproofed cloths, named A and B, were compared. A had a square meter weight of 710 grams, while B weighed 205 grams. It is to be noted that cloth A is chosen only for demonstration purposes, being heavier than any cotton cloth used for suits.

A consisted of Egyptian and B of American cotton. The permeation of water according to the above described method was determined. The two dishes were placed in a desiccator, containing concentrated sulfuric acid. Thus the relative humidity of the atmosphere above the dishes was almost 0 per cent. The result was that from about the second hour after starting the test both cloths showed practically the same rate of permeation. This fact appears still more noteworthy if one compares it to the enormous difference in the permeation through the two cloths of fluid water under pressure. To test the latter we used the apparatus and method as described by Heermann in Mikroskopische und mechanisch-technische Textiluntersuchungen Heermann und Herzog.

Cloth A did not show any permeability at the pressure of one meter, which was the maximum pressure available in the apparatus used. Cloth B, however, allowed the first drops of water to pass readily at a pressure of about 20 cm.

From the practical and hygienic viewpoints, waterproofed wool clothing presents an unfavorable peculiarity. Waterproofed wool clothing causes general discomfort on physical exertion. The warming action of the wool promotes sweat secretion, which may be so intense that not only the underwear is wetted, but liquid particles may penetrate as far as the water-proof piece. Then the water repellent action of the cloth prevents evaporation by causing drop formation, so-called pearling, which is analogous to what happens when water comes in contact with a fatty substance. Thus, there is an interference with the imbibition of the cloth, which normally would increase considerably the surface and therewith the rate of evaporation. This explains the diminution of the evaporation by waterproofed woolen goods. However, this untoward effect does not lead us to abandon water proofing of woolen coats.

Behavior and Treatment of Waterproofed Cotton Clothing During Use

Whitish spots are observed sometimes on the clothing after heavy rain, especially in those places where intense rubbing had occurred. The origin of these spots has been the object of controversy for a long time. When the damage occurred on piece dyed goods, one supposed that the superficial color had been rubbed off and the uncolored fiber thus become exposed to the sight. But this explanation is not consistent with the fact that the spots occur also on thoroughly yarn dyed goods. Others thought that the impregnating material had been washed out and become efflorescent as froth on the surface of the cloth.

But it has been proven that the waterproofing process, if properly carried out, cannot be made responsible for the spots. It was also said that the dyes were not fast. But even the cloths dyed with the fastest vat dyestuffs showed the phenomenon. The author has found that its cause lies in the damage done to the structure of the cotton fiber.

As long as the dyed fiber maintains its integral structure, it appears in the color given to it by the dyeing. But if the fiber is slit, a brightening takes place, which is not due to a destruction of dye, but to the destruction of the fiber with inclusion of air, thus producing this peculiar optical phenomenon.

This damage occurs when wet cotton clothing is rubbed, especially if certain factors have caused increased harshness. Under the microscope the cloth is seen to be covered with felt-like, slit, torn particles of fibers which glitter silvery on the colored ground.

The spots may occur on waterproofed as well as on non-waterproofed, on piece, yarn, or fiber dyed goods, with vat and other dyes.

In order to reduce the chances of this defect to occur, the manufacturer of the cloth has to select suitable yarn, the proper count of warp and filling, then the processing plant in waterproofing has to aim not only at an effective water-repellency, but also at a sufficient smoothness. Then the distributor must be instructed as to the characteristics of porous-waterproof clothing, so that he might inform the customer about these. The customer must also know that the spots may appear through strong rubbing during washing.

The washing of waterproof clothing is a difficult problem and requires thorough consideration, which is attempted in the following.

It is known that the compounds of calcium and magnesium in the water bind a part of the soap, forming insoluble salts and interfere with foaming to some extent. The production of insoluble substances results in a turbidity, which dulls the color of the cloth. This action has to be prevented by addition of acetic acid to the rinsing bath.

Furthermore, the washing soap causes the precipitation of aluminum compounds introduced into the cloth through waterproofing. This also contributes to a dulling of the fibers. Acetic acid counteracts this untoward effect, too.

Often one cannot avoid dry cleaning. Volatile cleaning agents remove not only fatty stains or similar dirt particles from the clothing but also fatty acids or waxes contained in the waterproofing material.

Depending on the method used for waterproofing, it will appear necessary in some cases to re-proof the clothing.

If aluminum compounds as waterproofing agents have been applied in such a manner that a sufficient amount withstands the organic solvent during the dry cleaning, the following treatment is advisable. A solution containing one ounce of soap in three gallons of water at a temperature of 120-130° F. will act in two ways if used after the dry cleaning. First, one has the effect of a mild soap wash besides the dry cleaning and secondly, new water-repellent substance is engendered from the inter-

action of the soap and the pre-existing aluminum. Then one rinses with lukewarm water, whereafter one treats with water which has been rendered slightly acid by the addition of acetic acid or vinegar. After drying one proceeds to hot ironing by means of a wet cloth covering the clothing.

Of course, one can use the soap wash method also without the preliminary dry cleaning.

The decrease of the water repellency of clothing during wearing may be due to various causes. Liquid sweat may have penetrated as far as the clothing and after the evaporation salts are left on it, which by their hygroscopic power reduce the water repellency.

The continuous passage of sweat in vapor form also diminishes somewhat the effectiveness of the waterproofing. For during adsorption of water vapor a very thin film of liquid water may be formed whereby gradually a slight swelling of the fibers occurs, although they are waterproofed. This involves a slight decrease of water repellency. This phenomenon can be satisfactorily explained on the basis of physico-chemical laws. It is the same which accounts for the production of a slight wetting ability of waterproof clothing due to heavy continuous rains.

The author, therefore, recommends the application of the following procedures after the clothing has been worn for a long time.

The piece is treated with cold water to which some acetic acid or vinegar has been added. After the removal of the clothing from the bath, the water is allowed to drip off. Then drying is performed preferably by heat; if this is not possible one dries in the open air whereafter hot ironing is done as outlined above.

If the waterproofing was only very slight and the clothing has been worn for a long time, it is good to add some aluminum acetate or formate to the acetic acid-water mixture either after the piece has been washed according to the method described above (dry cleaning, soap) or together with the acetic acid solution in the simple restorative treatment lastly mentioned.

In conclusion we would like to express the hope that the preceding suggestions, based upon scientific and practical investigations, carried out over a period of two decades, might be helpful in the choice of the most advantageous waterproofing method.

The procedures advised for the diminution of the loss of water repellency during use will interest especially those companies which hesitate to adopt the newer so-called "permanent methods."

Estimation of Ash—

(Continued from page 336)

in mill technology, the content of excess acid or base may be obtained.

3. *The electrodialytic determination of acidic and basic groups of fibers and other nondiffusible materials.* Application of the methods already described permits the estimation of the acidic or basic groups of substances which possess the following properties:

1. Nondiffusibility through cellophane or collodion.

2. The capacity to form tightly bound complexes with at least one species of cation (for the estimation of acidic groups), or with at least one species of anion (for the estimation of basic groups). The complexes must not readily dissociate or hydrolyze on dialysis or washing sufficiently prolonged to remove the unbound excess of these ions. Such complexes are formed by calcium in the case of dewaxed cotton, and by various acid dyes in the case of protein substances[7].

3. A large difference between the strength of the acidic or basic group to be estimated and the strengths of the other acidic or basic groups present. Thus, in cellulose, the estimation of the total number of carboxyl groups with calcium is possible only because these groups are very much more acidic than the hydroxyl groups; the latter do not combine with base under the conditions used.

The acidic (or basic) groups of substances which fulfill these three requirements may be determined by engaging the groups with a suitable cation (or anion) by treatment with a suitable base (or acid), removing the excess reagent by washing (if the product is insoluble) or dialyzing (if the product is soluble), and electrodialyzing to determine the amount of cation (or anion) remaining combined.

In order to illustrate the application of the above general procedure, the determination of the acidic groups of cotton is described below.

Table 5 gives data for the cationic ashes of samples of dewaxed cotton which had been soaked in lime-water for 3 hours, and washed with running distilled water for 24 hours. Comparison of these results with those of Table 1 shows that the lime-water treatment does not increase the cationic ash of dewaxed cotton appreciably. It has been stated above (Section III—1) that the hydrogen-ion equivalence of the cationic ash of dewaxed cotton corresponds closely with the number of carboxylate groups as determined by an independent method, the direct titration of these groups with acid. It therefore follows that the cationic ash of lime-washed dewaxed cotton is a measure of the total number of carboxylate groups of the fiber, and further, that the carboxyl groups of unprocessed cotton are almost entirely present as the carboxylates of various tightly bound ions[3].

TABLE 5

The Hydrogen-ion Equivalence of the Cationic Ash of Lime-washed, Dewaxed Cotton

Weight of Fibers, dry basis g	*Cationic Ash milliequiv.*	*Cationic Ash milliequiv./g*
0.749	0.0474	0.0633
.776	.0500	.0644
.780	.0506	.0649
	Mean	0.0642

The method has also been applied to the measurement of the acidic groups of depectinized cotton. The material was prepared by the modification of the American Chemical Society procedure for the purification of cotton

described by Worner and Mease[8]. This procedure involves the extraction of the fibers with a boiling 1 per cent solution of sodium hydroxide. At a later stage in the process the fibers are thoroughly washed with a 1 per cent solution of acetic acid, a treatment which undoubtedly removes some of the cations initially combined with the fiber or taken up from the basic solution. In order to replace cations on the carboxyl groups the samples were soaked in a saturated solution of calcium hydroxide for 3 hours, and washed with running distilled water for 24 hours. The results of determinations of the cationic ashes of these samples are given in Table 6. Samples 1-4 were extracted with alkali for 4 hours, and had a maximum acid-binding capacity of 0.008 milliequivalent per gram. Samples 5 and 6 were extracted with alkali for 8 hours, and had a maximum acid-bind capacity of 0.009 milliequivalent per gram[3]. The data show the close correspondence between the carboxylate content and the hydrogen-ion equivalence of the cationic ash.

TABLE 6

The Hydrogen-ion Equivalence of the Cationic Ash of Lime-washed, Depectinized Cotton

No.	*Weight of Fibers, dry basis*	*Cationic Ash*	*Cationic Ash*
	g.	*milliequiv.*	*milliequiv./g*
1	0.5168	0.0054	[a]0.0104
2	.7063	.0067	.0095
3	.8775	.0079	.0090
4	.754	.0069	.0092
			Mean 0.0095
5	.746	.0080	0.0107
6	.731	.0067	.0090
			Mean 0.0099

[a]Since the titer difference from which the data of these tables were computed had a precision of 1 part in 25, the data could be represented either as shown, or by one less significant figure. They are given as shown to permit a better estimate of their reliability.

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